REMARKS

Claims 1-5, 7, and 10-24 are presented for examination, of which Claims 1, 10, 15, and 20, which are the independent claims, have been amended to define more clearly what Applicants regard as their invention. Favorable reconsideration is requested.

Applicants note with appreciation the continued indication that Claims 3, 4, 12, 13, 17, 18, 22, and 23 would be allowable if rewritten so as not to depend from a rejected claim, and with no change in scope. These claims have not been so rewritten because, for the reasons given below, their base claims are believed to be allowable.

Claims 1, 2, 5, 7, 10, 11, 14-16, 19-21 and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,263,120 to Matsuoka in view of U.S. Patent 6,208,763 to Avinash.

As shown above, Applicants have amended independent Claims 1, 10, 15, and 20 in terms that more clearly define what they regard as their invention. Applicants submit that these amended independent claims, together with the remaining claims dependent thereon, are patentably distinct from the cited prior art for at least the following reasons.

Claim 1 is directed to a method of interpolating a first set of discrete sample values to generate a second set of discrete sample values using one of a plurality of interpolation kernels. Text regions are identified in the first set of discrete sample values depending on a local contrast indicator for each of the discrete sample values of the first set. Edge regions are identified in the first set of discrete sample values depending on an edge strength indicator and an edge direction indicator for each of the discrete sample values of the first set. The text regions and the edge regions are combined to form a kernel

selection map. The kernel selection map is cleaned by re-assigning orientations of any edge regions having isolated edge directions occurring in an otherwise uniformly directed local region of the first set of discrete sample values, according to the uniform direction. The interpolation kernel is selected using the cleaned kernel selection map for use in interpolating the first set of discrete sample values to generate the second set of discrete sample values.

Among the notable features of Claim 1 are that text regions are identified using a local contrast indicator and edge regions are identified using an edge strength indicator and an edge direction indicator. Support for these features can be found in the originally filed application, for example at Fig. 1, steps 105 and 110, and Figs. 2 and 3.[1] Also among the notable features of Claim 1 is that a kernel selection map is cleaned by reassigning minor edge pixels to a major orientation. Support for this feature can be found in the originally filed application, for example at page 13, line 24, to page 14, line 21.

By way of example, and as disclosed at page 9, lines 9 to 28 of the present application, at step 105 high contrast text regions are detected. At step 110 both edge strength and edge orientation of the image data are measured. The detected text regions and edge regions are combined into a kernel, or kernel-parameter, selection map for each input pixel at step 120. At the next step 125, the kernel, or kernel-parameter, selection map is cleaned. As described at page 9, lines 21 to 23, the cleaning process involves re-orientating edge regions to an underlying uniformly directed edge region or smooth

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[1]It is of course to be understood that the references to various portions of the present application are by way of illustration and example only, and that the claims are not limited by the details shown in the portions referred to.

background to produce a cleaned kernel selection map at step 130. Then, as described at page 13, lines 24 to 26, there are cases of isolated edge directions occurring in an otherwise uniformly directed local region. Further, as described at page 14, lines 3 to 6 of the present specification, at step 520 of the cleaning of the kernel selection map process, the major and minor edge orientations are identified and minor edge pixels are reassigned to the major orientation in the steps that follow, with the exception of identified text region pixels.

Matsuoka, as understood by Applicants, relates to an image data interpolation processing method. Matsuoka discusses a method comprising the steps of extracting data of a partial image from data of a multi-gradation original image (STEP 1), converting the partial image data into frequency data by using a frequency transformation matrix (e.g., the same size DCT) and storing the transformed data as coefficients of the matrix (STEP 2), calculating a mean of absolute values of the coefficients for each frequency domain (STEP 3), discriminating whether the partial image contains an edge portion by applying the mean coefficient value to conditional equations (STEP 4), selecting a filter for surface interpolation or linear interpolation on the basis of the discrimination result (STEP 5) and interpolating the data of the partial image (STEP 6). (See the Abstract.)

The Examiner concedes, at page 3 of the Office Action, that Matsuoka does not disclose using an edge direction indicator or cleaning the kernel selection map by re-orientating the edge regions according to any underlying edge direction. Applicants concur with this point.

However, the Examiner contends, at page 2 of the Office Action, that Matsuoka discloses identifying text and edge regions in the first set of set of discrete

sample values depending on the type of image content including an edge a strength indicator and a local contrast indicator for each of the discrete sample values of the first set, at columns 6 to 8.

Applicants submit, however, that Matsuoka does not teach or suggest identifying edge regions in the first set of discrete sample values depending on an edge strength indicator, as recited in Claim 1.

As described at page 11, line 22, to page 12, line 11 of the present specification, horizontal and vertical edge responses, referred to as *Gh* and *Gv* respectively, are determined. A gradient magnitude, *Gm*, is then determined from the strengths of *Gh* and *Gv* using Formula (5). The maximum gradient value in the R,G, and B color components is used to determine the overall edge gradient strength.

In contrast, Matsuoka merely discusses an image discriminating step (STEP 4) which discriminates the presence or absence of an edge-portion by substituting a corresponding mean coefficient value into conditional equations (see column 4, lines 42-46, of Matsuoka). These conditional equations are outlined below:

$f1>30$ and $f2<30$ and $f3<5$

$f1<8$ and $f2<5$ and $f3<5$

The above equations are obtained by analysis of mean coefficient values obtained through experimental frequency-conversion of various kinds of image data using two-dimensional DCT (see column 6, lines 2-10, of Matsuoka). These edge presence indicators do not determine edge strength and are distinctly different from the edge strength indicator of Claim 1.

Matsuoka is also completely silent regarding a local contrast indicator, recited in Claim 1. In fact Matsuoka never mentions the term "contrast". As described at page 10, lines 21 to 22 of the present specification, the local contrast between neighboring pixels is used as the basis of text region detection. Then, as described at page 11, lines 4 and 5, if a value C is over a threshold, *Ttxt*, the pixel *PO* is labeled as text region at step 225. The edge presence indicators of Matsuoka do not determine local contrast and are distinctly different from the local contrast indicator of Claim 1.

In any event, the Examiner contends, at page 3 of the Office Action, that Avinash discloses that it is known to identify edge regions using an edge strength indicator and an edge direction indicator (citing column 5, lines 31-67, and column 6, lines 1-65), and that Avinash further discloses a cleaning step of re-orientating the edge regions according to an underlying edge direction (citing column 8, lines 66 and 67, and column 9, lines 1-58).

At column 5, lines 53 and 54 of Avinash, the gradient magnitude Gmag and gradient direction Gdir are computed. Then, at column 8, line 66, to column 9, line 58, Avinash states that "With the structure of the image thus identified, orientation smoothing of the structure, as indicated at step 68 of Fig. 3, is carried out through logic such as that illustrated diagramatically in Fig. 9." In particular, at column 9, lines 63-67, Avinash states that "the intensity value for each structural pixel is set equal to the average intensity of a 1x3 kernel of pixels in the dominant direction for the pixel of interest." Accordingly, once Gdir is computed for a pixel it does not change; only the pixel intensity value is changed.

Applicant submits that nothing in Matsuoka nor Avinash, whether considered either separately or in any permissible combination (if any), would teach or

suggest cleaning the kernel selection map by re-assigning orientations of any edge regions having isolated edge directions occurring in an otherwise uniformly directed local region of the first set of discrete sample values, according to the uniform direction, as recited in Claim 1.

A hypothetical combination of Matsuoka and Avinash (again, even assuming such a hypothetical combination to be permissible) would merely relate to a method of interpolation, comprising the steps of converting partial image data into frequency data by using a frequency transformation matrix, storing the transformed data as coefficients of the matrix, calculating a mean of absolute values of the coefficients for each frequency domain, and discriminating whether the partial image contains an edge portion by applying the mean coefficient value to conditional equations, in order to detect the presence of edges. The method would also comprise the steps of determining the magnitude Gmag and gradient direction Gdir for each of the edges, and performing edge smoothing using the gradient direction Gdir. However, a Applicants submit that a combination of Matsuoka and Avinash (again, even assuming such a hypothetical combination to be permissible) would not teach or suggest re-assigning orientations of any edge regions having isolated edge directions occurring in an otherwise uniformly directed local region of the first set of discrete sample values, according to the uniform direction, as recited in Claim 1. By virtue of the features of Claim 1, excessive kernel switching which may result in visual artefacts in the interpolated image can be avoided.

The Examiner also contends, at page 3 of the Office Action, that "There is no limitation on how the interpolation kernel is selected" other than through the user of the kernel selection map. However, Applicants submit that based on a reading of Claim 1, a

person skilled in the relevant art would realize that the interpolation kernel is selected depending the information in the kernel selection map (i.e., the combination of text regions and the edge regions) and, in particular, on whether the information in the kernel selection map indicates that the set of discrete sample values comprises text regions or edge regions. These text regions and edge regions are determined based on a local contrast indicator (i.e., in the case of text regions), an edge strength indicator and an edge direction indicator (i.e., in the case of edge regions).

Accordingly, Claim 1 is seen to be clearly allowable over Matsuoka and Avinash, whether considered either separately or in any permissible combination (if any).

Independent Claims 15 and 20 are apparatus and computer readable medium claims, respectively, corresponding to method Claim 1, and Claim 10 is to a method claim similar to that of Claim 1; these three claims are believed to be patentable for at least the same reasons as those discussed above in connection with Claim 1.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

This Amendment After Final Action is believed clearly to place this application in condition for allowance and, therefore, its entry is believed proper under 37 C.F.R. § 1.116. Accordingly, entry of this Amendment After Final Action, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested. Should the Examiner believe that issues remain outstanding, it is respectfully requested

that the Examiner contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

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